

Appl. No. 10/004,010
Amdt. dated June 20, 2005
Reply to Office Action of May 19, 2005

Remarks

The present amendment responds to the final Official Action dated May 19, 2005. The Official Action objected to claims 21 and 22 for purportedly being duplicates of claims 16 and 17. Claim 20 was rejected under 35 U.S.C. §112, second paragraph as lacking antecedent basis. The Official Action rejected claims 1-5, 9-19, 21-28, and 37-41 under 35 U.S.C. §102(e) based on Greenberger U.S. Patent No. 6,411,979 ('979 patent). Claims 6 and 20 were rejected under 35 U.S.C. §103(a) based on the '979 patent in view of Greenberger U.S. Patent No. 6,675,187 ('187 patent). These grounds of rejection are addressed below.

The objection to claims 21 and 22 has been withdrawn as discussed in detail in the Interview Summary below. Claims 1, 3, 9, 15, 17, 20, 21, 23, 37, and 39 have been amended to be more clear and distinct. In particular, claims 1, 9, 15, 23, and 37 have been amended to clarify how the adders are controlled in order to add or subtract products produced by a multiplier. Support for this amendment can be found, for example, at page 11, lines 27-29 of the specification. Claims 3, 17, and 39 have been amended to clarify the extended precision operation. Claim 20 has been amended to address the antecedent rejection. Claim 21 has been amended to depend on claim 15. Claims 7-8 and 29-36 have been previously cancelled. Claims 1-6, 9-21, 23-28, and 37-41 are presently pending.

Interview Summary

The Examiner is thanked for the courtesy of a telephone interview with the undersigned concerning the above case on June 8, 2005. Dr. Pechanek, a co-inventor, also participated in the

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interview. During the call, the objection to claims 21 and 22 and the '979 patent as related to claims 1 and 3 were discussed. The Examiner recognized that claims 21 and 22 were distinct from claims 16 and 17 and, thus, withdrew the objection.

In discussing the '979 patent, it was pointed out that the adders used in the '979 patent did not have any input to receive control signals to determine which products are added or subtracted based on the type of complex multiplication being performed. Furthermore, the partial product summers in the '979 patent are not multipliers which receive an input to controllably route produced products to adders as claimed. Claims 1, 9, 15, 23, and 37 have now been amended to recite "multiplier means routing produced products to the second storage means in response to the received signal indicating the type of complex multiplication to be performed and aligning the produced products in the second storage means for subsequent addition or subtraction with each other, the adder means comprising an input to receive the signal indicating the type of complex multiplication to be performed, the adder means adding or subtracting the aligned produced products in response to the received signal."

Additionally, with regard to claims 3, 17, and 39, it was noted that the '979 patent uses the term "extended precision" in a non-standard way. In particular, the '979 patent version of "extended precision" is used to multiply larger numbers such as accomplishing a 32 bit multiply by summing four 16 bit partial products after being shifted. In contrast to the '979 patent, the extended precision storage means of claims 3, 17, and 39 as presently amended, is used to carry out accumulation of complex multiplication. For example, a target register, R_t , may accumulate with the preceding complex multiplication operation. If a carry results from accumulation

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operation, it is stored as an interim result in the extended precision storage means and is combined with the current results of the adder from a second cycle of operation. At the completion of the particular type of complex multiplication, the extended precision storage means stores the extended precision results.

Although specific claim amendments were not discussed and no agreements with respect to claims 1 and 3, it was suggested that these distinctions be made clear in the claims to define over the relied upon art.

Objection to Claims 21 and 22 as Duplicates

The Examiner is thanked for agreeing to withdraw this objection during the Interview.

35 U.S.C. §112, Second Paragraph Rejection

Claim 20 has been amended to address the antecedent basis rejection by changing "the second cycle" to "a second cycle."

The Art Rejections

As addressed in the Interview Summary and below, the '979 and '187 patents do not support the Official Action's reading of them. Further, the Applicants do not acquiesce in the analysis of the relied upon art made by the Official Action and, in light of the present amendments, the rejections based on the relied upon art should be withdrawn.

The Official Action rejected claims 1-5, 9-19, 21-28, and 37-41 under 35 U.S.C. §102(e) based on the '979 patent. Claim 1, as presently amended, reads as follows:

1. An apparatus for the two cycle computation of a plurality of types of complex multiplication, the apparatus comprising:
a first storage means for storing a first complex operand and a second complex operand, the first complex operand including real component X_r and

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imaginary component X_i , the second complex operand including real component Y_r and imaginary component Y_i ;

multiplier means for simultaneously performing multiplications in a first cycle of operation to produce products X_r*Y_r , X_r*Y_i , X_i*Y_r and X_i*Y_i , the multiplier means comprising an input to receive a signal indicating a type of complex multiplication to be performed;

a second storage means for storing products X_r*Y_r , X_r*Y_i , X_i*Y_r and X_i*Y_i ;

adder means for simultaneously performing additions and subtractions in a second cycle of operation to produce a conjugated or nonconjugated result depending on the type of complex multiplication to be performed, said multiplier means routing produced products to the second storage means in response to the received signal indicating the type of complex multiplication to be performed and aligning the produced products in the second storage means for subsequent addition or subtraction with each other, the adder means comprising an input to receive the signal indicating the type of complex multiplication to be performed, the adder means adding or subtracting the aligned produced products in response to the received signal; and

a third storage means for storing the results of said adder means.
(emphasis added)

The '979 patent discloses a three cycle complex number multiplier circuit. See, for example, '979 patent, Figs. 2 and 3. The '979 patent does not disclose and does not make obvious "the adder means comprising an input to receive the signal indicating the type of complex multiplication to be performed, the adder means adding or subtracting the aligned produced products in response to the received signal," as presently amended claim 1. See also claims 9, 15, 23, and 37. It should be noted that the '979 patent discloses that its partial product summer outputs can be routed to any of the adders according to appropriate control signals to permit a more general complex number calculation. '979 patent, col. 7, lines 3-5. However, this cited portion of the '979 patent applies to the routing from partial product summer outputs and

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should not be confused with controlling multipliers and adders based on the type of complex multiplication to be performed as presently claimed.

It should be further noted that Fig. 1b of the '979 patent illustrates +/- sign control to adders 20 and 22. The circuit of Fig. 1b is a partial product summer and performs simple multiplication. This control is determined by the sign of four signed digits SD1-SD4, where each signed digit indicates the addition or subtraction of zero or one of the eight multiples of the inputted multiplicand. '979 patent, col. 2, lines 30-35. These eight multiples are produced by a multiples generator 14 which produces an output signal that represents multiples of multiplicand Y from Y to $2^{(k-1)}Y$. '979 patent, col. 1, lines 34-37. These multiples are not produced products as presently claimed. Even if they were, the '979 patent does not disclose inputs of these partial product summers for receiving a type of complex multiplication to be performed as presently claimed.

The '979 patent does not disclose and does not make obvious "multiplier means routing produced products to the second storage means in response to the received signal indicating the type of complex multiplication to be performed and aligning the produced products in the second storage means for subsequent addition or subtraction with each other, the adder means comprising an input to receive the signal indicating the type of complex multiplication to be performed, the adder means adding or subtracting the aligned produced products in response to the received signal," as presently claimed in claim 1. See also claims 9, 15, 23, and 37

Dependent claims 6 and 20 were rejected under 35 U.S.C. §103(a) based on the '979 patent in view of the '187 patent. The '187 patent fails to cure the deficiencies of the '979

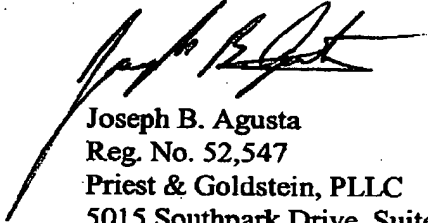
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patent. Since claims 6 and 20 depend from and contain all the limitations of claims 1 and 15, as presently amended, claims 6 and 20 distinguish from the references in the same manner as claims 1 and 15, respectively.

Conclusion

All of the presently pending claims, as amended, appearing to define over the applied references, withdrawal of the present rejection and prompt allowance are requested.

Respectfully submitted,



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